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**System for locking and adjusting the tilt of a vehicle seat and method for assembling said system**

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The invention relates to a system for locking and adjusting the tilt of two parts of a vehicle seat, such as a seat part and a backrest part, with respect to each other, comprising two fittings which can be fitted on each side of the vehicle seat and are connected to each other via a transmission rod acting as an adjusting means, the transmission rod engaging axially in each case in a fastening opening of a structural element of a fitting and being held in a profiled inner contour. Furthermore, the invention relates to a method for assembling such a system.

**Prior art**

20 Fittings for adjusting and locking the tilt of two components of a vehicle seat, such as a seat part and a backrest part, with respect to each other are known in numerous embodiments and described, for example, in the documents DE 198 45 698 A1, DE 195 22 854 A1 and US 4 836 608 A. The fitting for adjusting the tilt of backrests of motor vehicle seats that is disclosed in DE 195 22 854 A1 has a first articulated part and a second articulated part, one of which is connected fixedly to the seat and the other of which is connected fixedly to the backrest. In this case, the second articulated part is coupled pivotably to the first articulated part and has a latching toothed wheel which can be fixed in different pivoting positions by means of a locking lever formed therewith for engagement purposes.

25 The locking lever has a mating toothed wheel corresponding to the latching toothed wheel of the second articulated part. The two toothed wheels can be blocked in engagement positions by means of a blocking lever. The blocking

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lever is mounted pivotably on the first articulated part and locking lever and blocking lever have mutually complementary control surfaces. The blocking lever in turn bears an arresting lever, which is mounted 5 pivotably, can be displaced via an adjusting means and has a lug which, in a first pivoting position of the arresting lever and in the case of the blocking position of the blocking lever - this is the blocking position of the fitting - bears against a stop surface 10 of the first articulated part. In a second pivoting position, the lug is situated away from the stop surface of the first articulated part and therefore enables blocking lever and locking lever to freely pivot, i.e. to be unlocked.

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The device according to US 4 836 608 A also has a similar construction to the fittings mentioned. DE 195 22 854 A1 and DE 198 45 698 mention and illustrate Bowden cables, and US 4 836 608 A mentions 20 and illustrates a handling device formed integrally with the clamping element as adjusting means, for moving a structural element of the fitting, such as a clamping element, which is to be pivoted counter to the force of a spring and is also referred to or could be 25 referred to in the documents mentioned as clamping cam, unit of blocking lever and arresting lever, "operation lever" or clamping eccentric. If fittings of this type, which are usually also called "recliners", are fitted on each side of a vehicle seat, a synchronization is 30 necessary so that the fittings lock in the same angular position in each case during an adjustment of the tilt. In the case of recliners which are activated via Bowden cables, there is not sufficient excess travel in the system, and so an adjustment is necessary in order to 35 compensate for tolerances. This adjustment is usually undertaken in the mechanism on the Bowden cables.

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A system of the type described at the beginning, for which a transmission rod is used as the adjusting means, is described in GB 2 059 496 A. The transmission or actuating rod engages at both of its ends in 5 fittings which are fitted on each side of a seat. In this case, in particular, the actuating rod can engage axially in each case in a fastening opening of a structural element which serves, for example, for the clamping and has a profiled inner contour for holding 10 the transmission rod in a form-fitting manner. Due to the permissible tolerances of the various structural elements in the recliner, the profiled inner contour which holds the transmission rod can be at different positions from the left recliner to the right recliner. 15 This leads to distortions and makes a compensation necessary. Furthermore, the transmission rod, when passed directly through the seat, may be situated too close to the sitting region, and so it has to be moved via a mechanism.

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#### **Object**

The invention is based on the object of improving a system for locking and adjusting the tilt, of the type 25 described at the beginning, using structurally simple means in such a manner that an optimized synchronization between the two fittings, which can be fitted on each side of the vehicle seat, is made possible. In addition, the invention is based on the 30 object of indicating an improved method for assembling such a system.

#### **Achievement**

35 This object is achieved by an additional molded part which can be inserted into the fastening opening and can be fastened therein and has the profiled inner

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contour for holding the transmission rod in a fastening opening of the molded part in a form-fitting manner.

According to the method of the invention, this object  
5 is achieved in that, in a preassembly step, the additional molded profile part, which has the profiled inner contour for holding the transmission rod in a fastening opening of the molded profile part in a form-fitting manner, is inserted into the fastening opening  
10 of the structural element of the fitting, which is preferably situated in a locking position, and is fastened therein, after which, in a main assembly step, the transmission rod is inserted into the fastening opening of the molded profile part.

15 With the use of the molded part according to the invention, the two fittings can therefore be synchronized at a very early point, i.e. already at their assembly stage, and do not have to be coordinated  
20 with each other later in a further assembly operation. Different fitting positions in each case of the structural element, which has the fastening opening for the transmission rod, which positions may occur due to the permissible tolerances in the two fittings, can  
25 thereby be compensated for in a simple manner, and the transmission rod can be fitted in a manner free from distortion. In this case, the profiled inner contour of the molded profile can be oriented in any desired position in an infinitely variable manner  
30 advantageously irrespective of the design of the contour of the fastening opening.

In a preferred, particularly assembly-friendly embodiment, the molded part can be fastened in the  
35 fastening opening in a frictional and form-fitting manner, in particular by being pressed in. In this case, in order to increase the form-fitting frictional

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connection, the fastening opening of the structural element can have a profiled structure on its periphery, in particular a fine toothed arrangement on its inner circumference.

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Further advantageous embodiments of the invention are contained in the subclaims and in the special description below.

10 The invention is explained in more detail with reference to an exemplary embodiment which is illustrated in the attached drawing, in which:

15 fig. 1 shows, in a perspective illustration, a system according to the invention for locking and adjusting the tilt,

20 fig. 2 shows, in an enlarged, perspective exploded illustration in comparison to fig. 1, a structural element of a fitting of the system according to the invention, a molded profile part which can be inserted into the structural element and a transmission rod.

25 In the various figures of the drawing, identical parts are always also provided with the same reference numbers, and so they are generally also only described once in each case.

30 A system according to the invention for locking and adjusting the tilt of two components of a vehicle seat with respect to each other can be used in particular for adjusting the tilt of a seat part and a backrest part.

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Fig. 1 shows, a system of this type comprises two fittings B1, B2 which can be fitted on each side of the

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vehicle seat and are connected to each other via a transmission rod R acting as an adjusting means.

As fig. 2 illustrates in detail, the transmission rod 5 engages axially (axis X-X) in each case in a fastening opening O of a structural element BS of a fitting B1, B2. According to the invention, an additional molded profile part F is provided which can be inserted into the fastening opening O of the structural element BS 10 and can be fastened therein and has a fastening opening OF with a profiled inner contour K for holding the transmission rod R in a form-fitting manner.

The structural element BS of the particular fitting B1, 15 B2 in which the transmission rod R can be fastened or is fastened in the installation state may be, in particular, a pivotable clamping element of the fitting B1, B2. Each fitting B1, B2 may comprise a first fitting part 1 and a locking element (not illustrated) 20 which can be fixed in certain positions with respect to the first fitting part 1 under the action of a spring and is fastened to a second fitting part 2 which can be fixed in a changeable manner in its tilt in relation to the first fitting part. The clamping element as 25 structural element BS serves to cancel the fixing of the locking element on the first fitting part 1 counter to the force of the spring.

The fastening opening O of the structural element BS 30 can preferably - as illustrated - have a profiled structure on its periphery, in particular a fine toothing Z arranged on its inner circumference.

The molded profile part F can preferably be designed, 35 in a favorable manner in terms of production, as a plastic bushing. It may advantageously consist of reinforced plastic, in particular of glass fiber

reinforced polyamide, such as PA 6.6. GF with 15 per cent glass fibers.

5 The molded profile part F can thereby be fastened in the fastening opening O in a frictional and form-fitting manner, in particular by being pressed in - which takes place cold under the formation of chips or is associated with a forming of the outer contour of the molded profile part F after heating, with the 10 result that a secure and rotationally fixed fit in the structural element BS is obtained.

15 During the fitting in the fastening opening O of the structural element BS, the molded profile part F may be positioned in such a manner that its profiled inner contour K is arranged in a defined position with reference to the fitting B1, B2. With the production of the reference, the fitting B1, B2 should preferably already be in a very substantially assembled and locked 20 state, with the result that the tolerances which are permissible in the unlocking are not effective.

25 In this case, the defined position may be defined by one or more of a marking point, which is identified by way of example in fig. 2 by the reference number P, of the profiled inner contour K from one or more reference points of the fitting B1, B2, such as axes of holes present in the fitting. The axes may, on the one hand, be the axes of openings in the first fitting part 1, 30 such as the pivot axis X1 of first fitting part 1 relative to the second fitting part 2 and/or the axes X2, X3 of fastening openings for a component of the seat, such as a seat part, or, on the other hand - as an alternative or in addition - the axes of openings in 35 the second fitting part 2, such as again the pivot axis X1 of first fitting part 1 relative to the second fitting part 2 and/or the axis X4 of a fastening

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openings of the fixing element and/or the axes X5, X6 of fastening openings for a component of the seat, such as a backrest part. In this case, the reference to the second fitting part 2 is the preferred technical  
5 solution, since the molded profile part F is fitted in the second fitting part 2 and tolerances which become effective are therefore smaller than with reference to the first fitting part 1, which does not have any direct connection to the molded profile part F. The  
10 defined position may be described - as mentioned - by distances, but also by angles being a Cartesian or polar system of coordinates.

The profiled inner contour K of the molded profile part  
15 F may be formed - as illustrated - radially symmetrically to its central axis or to the longitudinal axis X-X of the transmission rod R. It is characteristic of rotationally symmetrical figures, such as regular polygons, that they contain as  
20 component parts recurring basic figures, such as triangles, which can be brought into overlap by rotation through a certain central angle. This central angle can advantageously be 30°, 60° or 90° in the case of a rotationally symmetrical embodiment of the inner  
25 contour K. In the illustration shown, in which the transmission rod R has a hexagonal profile, the central angle is 60°.

As an alternative, the profiled inner contour K of the  
30 molded profile part F may also be formed asymmetrically with reference to the longitudinal axis X-X of the transmission rod R. As a result, a coded assembly, i.e. an assembly which can only be carried out in a certain position, of the rod R in the molded profile part F is  
35 possible.

The transmission rod R, both in the case of a

symmetrical and asymmetrical design of its profile, may have, upon its axial engagement in the profiled inner contour K of the molded profile part, a maximum play of 4°, during a rotational movement about its axis X-X, in particular a play of +/- 2°, on each side of the axis X-X. This permissible play facilitates the installation and brings about a further compensation for the tolerance-induced differences in position of the structural element BS in the one fitting B1 and in the other fitting B2, but without the functionality of the system according to the invention being impaired.

According to the method of the invention of the system for locking and adjusting the tilt of two components of a vehicle seat with respect to each other, in a preassembly step, the additional molded profile part F is inserted into the fastening opening O of the structural element BS and is fastened therein. This takes place after the fitting B1, B2 as such is already assembled, or is at least assembled to the greatest possible extent. The latter means that, in the assembly, individual parts of the fitting B1, B2, such as a wall part or the like, may still be missing. In this case, the operating capability of the fitting B1, B2 is to be produced to the extent such that the locking position can be produced in which the molded profile part F is preferably to be inserted.

In the main assembly, it is possible, on the one hand, to insert the transmission rod R at its ends into the two fittings B1, B2 and then to fit the fittings B1, B2 to the component of the vehicle seat, for example the seat part or backrest part. On the other hand, it is also possible first of all for only one fitting B1, B2 to be connected to one end of the transmission rod R in the described manner, and then for both fittings B1, B2 - one of which without the molded profile part inserted

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- to be fastened to the component of the vehicle seat, and only subsequently for the molded profile part F to be inserted into the other fitting B2, B1 in each case and for the other end of the transmission rod R to be 5 inserted into the molded profile part F, with the transmission rod R advantageously serving as an installation aid.

Before the main assembly step is carried out, it is 10 also possible for the fitting B1, B2 without molded profile part F or as a preassembled unit of fitting B1, B2 and molded profile part F to be subjected to a painting operation, in particular a cathodic dip painting operation, at a temperature of 180°C to 200°C. 15 The painting is preferably also to be carried out in the locking position of the fitting B1, B2, so that the bearing surfaces of the corresponding fitting parts, which are in contact in the locking position, are not coated by the paint which would result in the 20 production of further tolerances. Of course, in this case the thermal stability of the material of the molded profile part F has to exceed the temperatures to be expected during painting. As an alternative, the 25 metallic components may also be painted before the molded profile part F is inserted.

The invention is not restricted to the exemplary 30 embodiments illustrated, but also comprises all of the embodiments acting with the same effect within the context of the invention. Thus, in particular, the shaping of the inner contour K of the profile part F may deviate from the embodiment illustrated. Furthermore, it is also possible for the molded profile part F to be fastened in the fastening opening O of the 35 structural element in a different manner from being pressed in - for example, bonding or injection molding as a type of fastening also appears possible. Injection

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molding is preferred insofar as the molded profile part F can thereby also be given undercuts which advantageously promote the formation of the form-fitting connection.

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Furthermore, the expert can supplement the invention by means of additional advantageous measures without departing from the framework of the invention. Thus - as likewise illustrated graphically - the transmission 10 rod R can be laid without an additional mechanism in a region which is sufficiently spaced apart from a sitting region - at the front in fig. 1.

A further advantage, hitherto not mentioned, of the 15 system according to the invention is that unlocking levers which are effective in the fittings B1, B2 can always be brought into a standard nominal position, with nominal position being understood to mean a position as has been conceived on the drawing board. 20 For example, this nominal position may be a central position of three possible locking positions with a different tilt of the fitting parts 1, 2 with respect to each other in each case. This advantage is in particular of importance if the system according to the 25 invention is used in vehicle seats which are situated in the second or the third row in a motor vehicle, with it also being possible, for example, for three seats arranged next to one another to be provided with the system according to the invention. The handles used for 30 operating the system can be brought here into the same vertical positions in each case and Bowden cables, which may be provided for the adjustment, of the different systems according to the invention can be designed with the same, fixedly set length in each 35 case.

With regard to the component BS, it should also be

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added that this may be a clamping element which is designed in a manner known per se and - as described at the beginning - is referred to as clamping cam, clamping eccentric etc. However, it may also be a 5 component which differs in its design from the known clamping elements.

**Reference symbols**

1. First fitting part of B1, B2
2. Second fitting part of B1, B2

B1 First fitting  
B2 Second fitting  
BS Structural element of B1, B2, in particular  
clamping element  
F Molded profile part  
K Contour in OF  
O Fastening opening of BS  
OF Fastening opening of F  
P Marking point of K  
R Transmission rod  
X1-X6 Axes in B1, B2  
X-X Longitudinal axis of R, central axis of OF  
Z Fine toothing in O